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Chaetospermum setosum sp. nov. from the Western Ghats, India

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Abstract – A new species of *Chaetospermum*, *Ch. setosum*, is described based on the presence of conidiomatal setae and differences in conidial size and shape. This species occurs on *Mangifera indica* (*Anacardiaceae*) collected from Bhima Shankar forests in the Western Ghats of Maharashtra, India. The presence of conidiomatal setae is a unique character that differentiates this species from related taxa.

Key words – anamorphic fungi, *Efibulobasidium*, *Sebacinales*

Introduction

During July 2009 a survey was conducted to explore the microfungal diversity in the natural forests of Bhima Shankar situated in the northern part of the Western Ghats, India, at 19°40'00"–19°42'09"N 73°29'16"–73°38'06"E with an altitude of 945 msl. The forest types are mainly evergreen and semi-evergreen with rainfall up to 6000 mm per annum (Janardhanan 1966). An unusual *Chaetospermum* species was found on fallen leaves of *Mangifera indica*. The presence of gelatinous conidiomata, holoblastic sympodial conidiogenesis, and cylindrical, non-septate conidia with tubular appendages are the distinguishing features of the genus *Chaetospermum* (Sutton 1980; Nag Raj 1993). Species of *Chaetospermum* are recorded worldwide as common saprophytes isolated from freshwater and litter. Sequences of two species of *Chaetospermum* suggest that members of this genus are basidiomycetes in the order *Sebacinales* (Rungjindamai et al. 2008). The anamorph-teleomorph relationship between

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Chaetospermum and a known species of *Sebacinales*, *Efibulobasidium albescens* (Sacc. & Malbr.) K. Wells, was suggested by Wells & Bandoni (2001) and confirmed recently by Kirschner & Oberwinkler (2009). *Chaetospermum setosum,* which differs from the other five species described in that genus based on the presence of conidiomatal setae, cylindrical or V- and Y-shaped conidia, and number of polar appendages, is described as new to science.

Materials and methods

Conidiomata of the fungus were isolated from the lower surface of fallen leaves and observed under a Nikon Binocular stereo microscope (Model SMZ – 1500 with Digi-CAM, Japan). The serial dilution method was used to isolate this fungus (Pramer & Schmidt 1965) and the hyphal elements from the growing margin of the pure colonies developing from single spores were transferred to new Potato Dextrose Agar plates (PDA). For morphotaxonomic studies and photomicrographs an Olympus CX-41 (Japan) microscope was used. Conidia, setae, and conidiophores were measured using an ocular micrometer. The growth patterns of the colonies were also studied on different culture media viz. Czapek Yeast Autolysate Agar (CYA), Malt Extract Agar (MEA), Potato Carrot Agar (PCA), and PDA (Himedia Mumbai, India). Development was also observed on modified 2% agar media (2 g crushed autoclaved mango leaves mixed in 2% agar). The specimens were deposited in Ajrekar Mycological Herbarium (AMH) and the culture was accessioned and preserved in National Fungal Culture Collection of India (WDCM-932), Agharkar Research Institute, Pune, India.

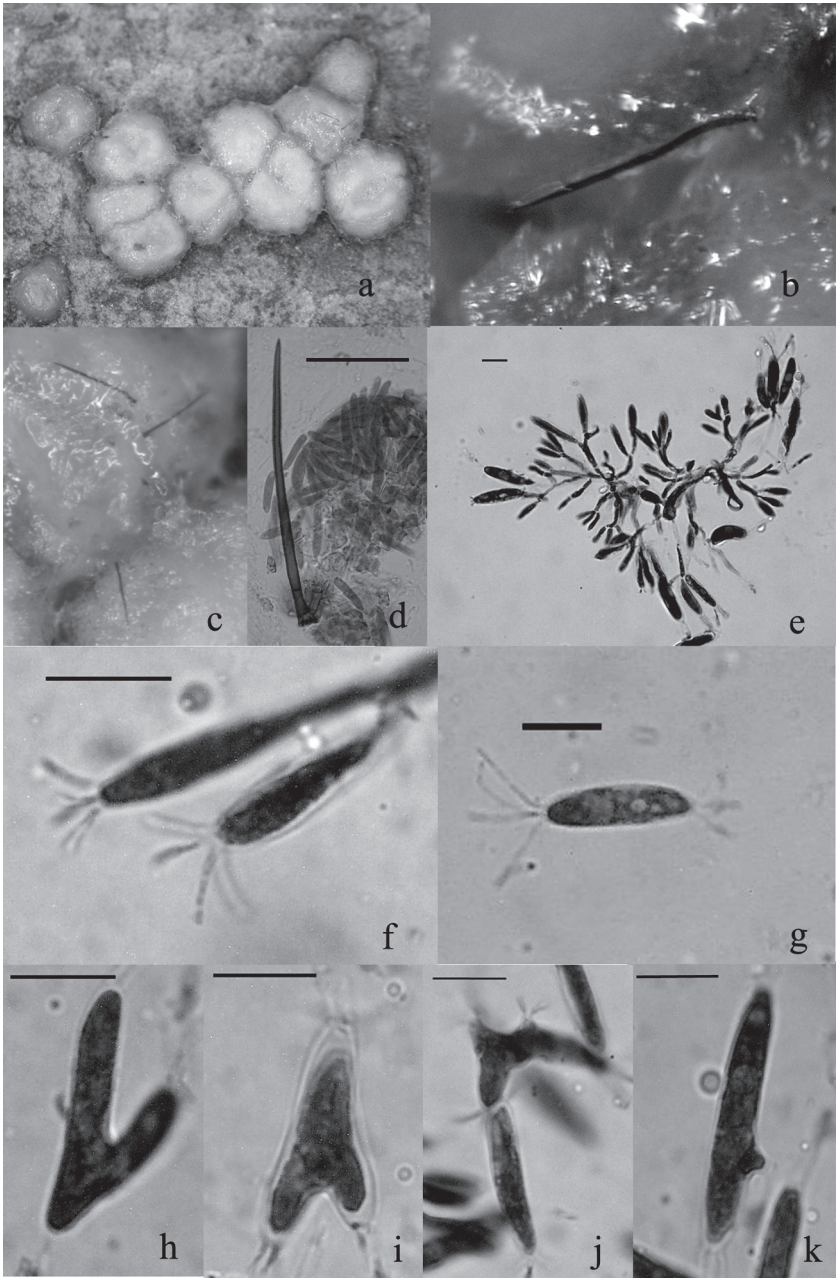
Taxonomic description

Chaetospermum setosum Rajeshkumar, S.K. Singh & P.N. Singh, **sp. nov.**

MycoBank MB 515508 Plates 1, 2

Foliicola. Conidiomata pycnidioidea, 300–750 µm diam., subepidermalia, primum immersa, postremo erumpentia, gelatinosa, nivea ad cremea ubi humida, palllide brunnea ad atrobrunnea ubi sicca. Setae marginales 120–132 µm longae, 5 µm latae ad basim, pallidae ad atrobrunneae, gradatim contractae versus apicem, acuminatae, crassitunicatae, solitariae vel binatim, 1–2-septatae ad basim. Conidiophora ramosa, hyalina, laevia. Cellulae conidiogenae cylindracae, holoblasticae, sympodiales, conidia maximam partem terminalia interdum lateralia, 1–4 in fasciculis. Conidia unicellularia, cylindracea vel variabilia in forma, recta vel curva, hyalina, laevia, guttulata, apice obtusa, 17–29(–40) × 4.4–7 µm. Appendices polares, nonramosae, tubulares, 2–5, praeciupue 3–4, 7.5–12.5 µm longae.

Plate 1. *Chaetospermum setosum* (holotype). a. Habit. b–c. Conidiomatal setae. d. Conidiomatal setae and conidia. e. Conidiophores branching and conidiogenous cells. f. Conidial development g. Mature conidia with appendages. h–k. Branched and irregularly shaped conidia with appendages. Bars: d = 50 µm; e–k = 10 µm.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Etymology: from Latin *setosus* referring to the conidiomatal setae present in this species.

Holotype: India, Bhima Shankar, Western Ghats, Maharashtra, on fallen leaves of *Mangifera indica* L. (*Anacardiaceae*) 30 Nov 2009, K.C. Rajeshkumar, AMH 9299. (Ex-type culture NFCCI 1912.)

Foliicolous. Conidiomata pycnidial, 300–750 µm diam., initially immersed, subepidermal, ultimately erumpent, opening by an irregular split in apical wall, gelatinous, pearl white to creamish when moist, pale brown to dark brown when dry, scattered to gregarious, confluent. Setae marginal, 120–132 µm long, 5 µm wide at the base, pale to dark brown, gradually tapering towards the pointed apex, wall thickened, solitary or in pairs, one to two septate at base. Conidiophores arising from innermost wall of conidiomata, branched, hyaline, smooth. Conidiogenous cells cylindrical, holoblastic, sympodial, conidia mostly terminal, sometimes lateral, 1–4 in clusters. Conidia unicellular, cylindrical or variable in shape, sometimes branched, each branch bearing appendages, straight or curved, hyaline, guttulate, smooth-walled, apex obtuse, 17–29 (–40) × 4.5–7 µm (mean 24.2 × 5.3 µm), length-width ratio 4.6:1; appendages polar, unbranched, tubular, 2–5 at each end, usually 3–4, 7.5–12.5 µm long.

Teleomorph: Unknown; no sexual state or fungus resembling *Efibulobasidium* was present near the specimen.

Colonies on PDA slowly growing, 15 mm diam. after 7 days and 25 mm diam after 15 days, white, dull white to pale creamish white, with slight ridges and furrows, smooth, flat, margin irregular, aerial mycelium scanty, reverse creamish or dull white. Colonies on MEA slowly growing, 10 mm diam. after 7 days, white, velutinous, smooth, margin irregular, reverse white to off-white. Colonies on PCA fast growing, 60 mm diam. after 7 days, white or off-white, mycelium immersed forming a film over media, flat, margin regular, colonies rounded, reverse white to off-white. Colonies on CYA fast growing, 65 mm diam. after 7 days, creamish white, mycelium immersed forming thin flat colonies, margin regular, reverse white to off-white. Sporulation and conidium morphology on these media were similar to those in nature, but setae were not found.

Sterile seta-like structures developed from the conidiomata in culture grown on modified 2% agar media with crushed autoclaved mango leaves. The sterile hyphae were hyaline or hyaline with dark brown pigmented areas scattered on it, thin-walled, wavy, with a broader base and blunt tip arising from the margins of the gelatinous conidiomata. Sporulation on this medium was poor.

Discussion

Saccardo (1892) established the genus *Chaetospermum* Sacc. based on *Tubercularia chaetospora* Pat. (Patouillard 1888), now *Ch. chaetosporum* (Pat.)

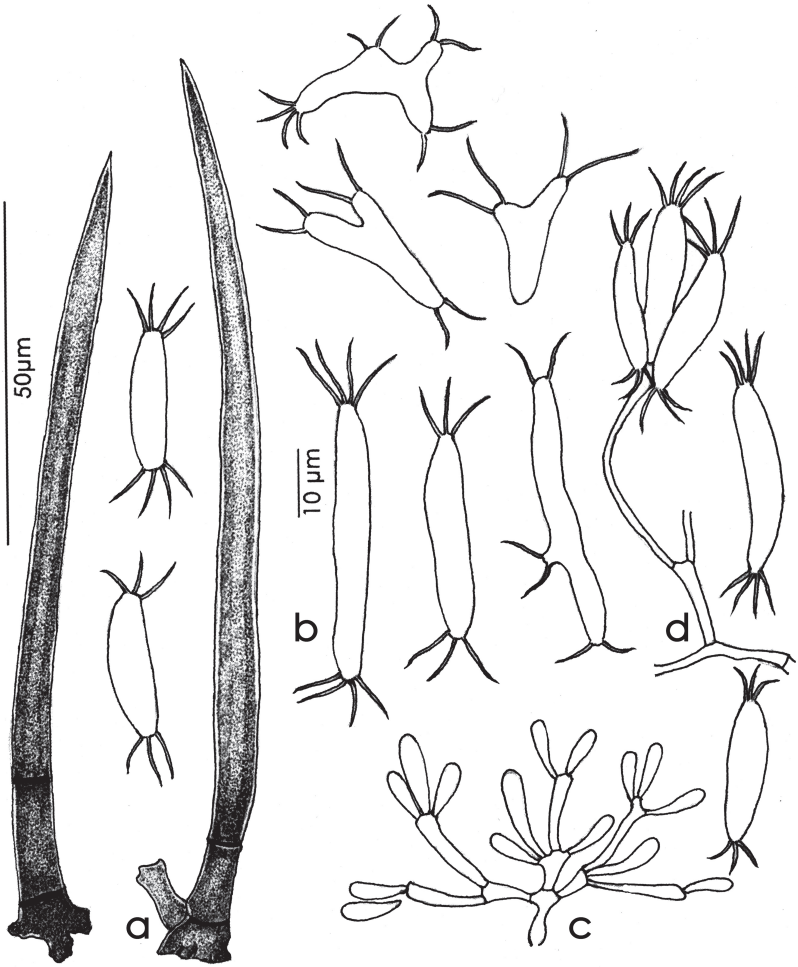

Plate 2. *Chaetospermum setosum* (holotype).
a. Conidiomatal setae. b. Mature conidia with appendages. c. Conidiophores branching and conidiogenous cells. d. Conidiophores and terminal clusters of conidia.
Bars: a = 50 µm; b–d = 10 µm.

A.L. Sm. & Ramsb. (Smith & Ramsbottom 1914). Saccardo (1892) published a superfluous new name for the type, *Ch. tubercularioides* Sacc., nom. nov., nom. illegit.; this is clearly a homotypic synonym, and not heterotypic as Nag Raj (1993) mistakenly indicated. Nag Raj (1993), who provided the most recent account of the genus *Chaetospermum,* accepted four species: *Ch. chaetosporum, Ch. artocarpi* (Nag Raj) Nag Raj, *Ch. camelliae* Agnihothr., and *Ch. gossypinum*

(G.F. Atk.) Nag Raj. He separated these species based on conidial length-width ratio, conidial width, and the position of appendages. He also clarified that conidial appendages in all the taxa in this genus are tubular. Previously, Sutton (1980) had accepted three species of *Chaetospermum* viz., *Ch. carneum* Tassi, *Ch. chaetosporum* and *Ch. gelatinosum* Petch (1917); however, Nag Raj (1993) placed *Ch. gelatinosum* in synonymy with *Mastigonema gelatinosum* (Berk. & Broome) Nag Raj and, following an examination of the type specimen, considered *Ch. carneum* a nomen dubium. Talde (1981) described *Chaetospermum indicum* Talde from India. The type specimen is missing in AMH and not available for re-examination. The description and illustration of *Ch. indicum* suggest that this species is identical with the type species, *Ch. chaetosporum*. Thus, *Ch. indicum* is treated here as a synonym of *Ch. chaetosporum*.

In the present study *Chaetospermum setosum* is proposed as a new species based on its unique morphological characteristics including the presence of conidiomatal setae, variously shaped conidia, and number and origin of the conidial appendages. The presence of conidiomatal setae has not been previously described in *Chaetospermum*. The conidial appendages are polar in *Ch. artocarpi* (as in *Ch. setosum*) but are circumpolar to sub-polar or lateral in the other two species. Although the presence of polar appendages in *Ch. setosum* suggests an affinity with *Ch. artocarpi,* they are more variable, with as many as 5 appendages sometimes present.

Infundibura adhaerens Nag Raj & W.B. Kendr. (anamorph of *Helicogloea angustispora* L.S. Olive) is another basidiomycetous anamorph that produces sterile seta-like structures in nature as well as culture. Different authors (Nag Raj & Kendrick 1981; Matsushima 1996; Wu et al. 1997) have given different descriptions for sterile hyphae (setae) in this species. Kirschner (2004), who describes them as hyaline, aseptate, and thick-walled, notes that these differences may be due to intraspecific variation, environmental influences, or aging. *Chaetospermum setosum* also produces setae in nature and sterile hyphae (setae) in culture. In nature the setae are dark brown, erect, with pointed tips, but in culture hyaline or hyaline with dark brown pigmented areas, thin-walled, wavy, and bluntly tipped. This observation indicates that setal characteristics depend on environmental factors and culture conditions.

Key to species of *Chaetospermum*

1. Conidiomata with marginal setae; conidia cylindrical to V- or Y-shaped, appendages polar, 2–5 at each end. ..... *Ch. setosum*
1. Conidiomata without setae; conidia ellipsoidal to cylindrical 2
2. Appendages polar, 3, rarely 2, appendages on each conidium; conidia 18–26 × 4.5–5.5 µm ..... *Ch. artocarpi*
2. Appendages circumpolar to subpolar or lateral 3

3. Appendages circumpolar to subpolar; conidia 26–41 × 8–12 µm . . . . . *Ch. chaetosporum*
3. Appendages subpolar or lateral; conidia less than 8 µm wide 4
4. Appendages 9–20 µm long; conidial length-width ratio 5.5:1 . . . . . *Ch. camelliae*
4. Appendages 18–20 µm long; conidial length-width ratio 6.3:1 . . . *Ch. gossypinum*

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